THE KAGI MULTI-FUELED BURNER

The Kagi Multi-fueled Burner (KMFB) is capable of burning a variety of liquid oils and is uniquely different from other multi-fueled burners on the market in that it can safely burn No.1 and No.2 furnace fuels as well as other virgin furnace fuels ranging from No.1 to No.6 in viscosity.

A GENERAL REVIEW OF HOW ALL MULTI-FUELED BURNERS WORK:

Virgin furnace fuels and waste oils up to 50 SAE viscosity ar pumped from a remote storage tank to the burner, the need signal d by a switch on the burner which turns the oil pump on and off. Th oil is monitored and regulated by an oil regulator to a desired pressure and introduced into a tank or an aluminum block which houses a heating element, preset to heat the thicker viscosity oil to thin it for atomization. Since waste and thicker furnace oils may have large particles in suspension, a discharge nozzle with a large orifice is used, and the heavy oil is sucked out from the nozzle and atomized with compressed air. Preheating the thick r oil is necessary to lower the flash point and reduce the viscosity in order to break up the larger oil droplets into a combustible vapor. All waste oils that are burned generally need to be heated to at least 120 F to ignite.

All waste and multi-fueled oil burners sold have various problems which the KMFB burner addresses and eliminates, making th KMFB burn r th most r liable and asy to s rvic multi-fu l d burn r n the market. The KMFB burn r has b n sp cifically d sign d to deal with ach on of th s problems, which ar :

OIL NOZZLE DRIPPING:

Waste oil has many colloidal particles in suspension. In other burners, shut off valves and other devises are used to minimizes this problem, but they do not cure it as the particles prevent a good liquid-tight seal. The KMFB burner addresses this problem with the installation of a miniature compressed air tank between the discharge nozzle and the pressurized air solenoid. When th KMFB burner cycles off, the air in the pressured tank blows out th residual oil and burns it.

2. THE KAGI SPECIAL RETENTION FLAME CONE:

Most of the retention flame cones used on other burners were designed for use with No.1 and No.2 furnace fuels. Waste oils contain unburnable particles that clog the ventilating holes in th conventional retention flame cone. The Kagi flame cone is design d with a minimum of air flow resistance and has a self-cleaning effect for debris that can accumulate on the flame cone.

3. FOUR NEON INDICATING LAMPS:

On the KMFB burner, there are four indicating lamps, red, yellow, green and white.

a. The red lamp indicates that current to the burner is "ON", mainly for safety reasons. Some other burners also have this feature.

b. The green indicating lamp shows when the preheater is at its optimum temp ratur and the burn r is r ady to fir . Oth r burners do not hav this f atur .

c. Th y llow indicating lamp shows that th oil/fu l pump is working. This is another safety f ature as wh n the switch that turns the oil pump on/off fails, it commonly fails in a "closed circuit" position which could be dangerous. Other burners that use a similar switch to turn the pump on/off do not have this featur .

d. The white indicating lamp shows that the preheater which heats the waste oil to combustion temperature is cold and has be n turned off. This is another safety feature of the KMFB burner, as heating No.1 and No.2 furnace fuels to 140 F. lowers the centistok viscosity to under six on the scale, making furnace fuels as thin as gasoline. (Many technicians have been stumped on how to simply light a lamp when the current to the heating element is turn d off). The KMFB burner has this feature, but other burners do not.

4. MULTI-FUNCTION THREE POLE SWITCHES:

There are two TP/TT switches on the Kagi burner. The one on th left of the burner control panel has three positions-all the way up for turning the preheaters on to burn thicker oils; centre position for burning No.1 and No.2 furnace fuels, and the bottom down position for manually turning the remote pump on/off. Th last feature makes it convenient to prime the air out of the fuel piping system without turning the burner on. The TP/TT switch on the right side of the burner control panel turns the oil solenoid off to allow burners equipped with an on-board mounted fuel pump t spin without igniting the burner. Other burners made today do not hav all of th s features!

5. SPECIAL UNIQUE WIRING TO THE HEATING ELEMENTS:

Waste oil burners generally have only on h ating element to preheat the oil and compressed air used for atomizing the thick oil. The KMFB burner uses two heating elements, one heats the air for atomizing and the other heats the oil to the proper temperature for ignition. IMPORTANT NOTE: Other burners on the market have only one heating element to heat the atomizing air and oil and ar designed so that the oil/air heater is on constantly, overheating the trapped oil in the preheater assembly, causing it to oxidize the oil and sludge up. This sludge breaks off and plugs the discharge fuel nozzle. This is an important patentable design of the Kagi burner in that the heating element that heats the oil for combustion is dormant, and comes on only when the burner calls for heat. This minimizes oxidation of the heavy oils in the preheater. On conventional burners sold, the flame characteristic is good on first ignition of the burner; however as the colder oil enters th preheater and exits out the nozzle, the flame loses much of its thermal efficiency. The hotter oil can be heated for combustion without carboning, the more efficient the flame becomes.

6. SPECIAL DIAMETER PREHEATER DRILLING DIRECTLY ONTO THE SHEATH OF THE HEATING ELEMENT:

Other manufacturers of waste oil burners have designed the oil to pick up heat by circulating the oil back and forth through the pr h ater to increase the temperature to proper ignition. A l ngthy passag is n d d for the oil to pick up th h at. Th rationale is to us the prop r ar a to conform with th watt

density rule. Th watt d nsity formula is used t det rmin th area/wattage for raising the temp ratur of a giv n liquid. Since the oil burned is less than four gallons per hour for a large BTU/hr burner, slowing the oil flow by lengthening the oil passages allows the oil to accumulate debris, and when this accumulation breaks off, it plugs the nozzle. Debris in a fast-flowing river does not litter the banks; however, when the flow slows down, th debris drops where it slows down. The KMFB burner has a larg orifice and short passages, allowing the cold oil to flow directly onto the surface of the heating element. This heats the oil mor quickly because of the direct contact to the heating element sheath and allows fast movement of the oil through the oil passages. The oil passages in the preheaters of conventional burners must b wire-brushed as early as 3000 hours or even less, a tedious expenditure of labor.

7. UNRESTRICTED BLAST TUBE/COMBUSTION AIR:

Many waste oil burners on the market are converted standard oil burners where the preheater is inserted into the combustion air tube, commonly called the blast tube, which results in restricting the air flow necessary for combustion. Burning a given amount of oil requires a given amount of combustion air for a complete burn; hence the formula of combining chemical proportions comes into play. When the BTU/hr output of a burner is increased, th r stricted air flow reduces the amount of air needed for compl t combustion. Th se burn rs do what they are d signed for, but mor or l ss satisfactorily, increasing th oil flow to attain high r BTU

r duc s th combustion fficiency. Th KMFB burner addr sses this problem by not putting the preh ater ass mbly in th blast tube area

THE NEW KAGI RETENTION HEAD (FLAME CONE)

REVIEW OF THE PROBLEMS WITH OTHER RETENTION HEADS

When waste oil burners are lit up, a tremendous amount of oil impingement (unburnt oil particles) results because the waste oil is not heated to the desired temperature due to the delayed heating of the oil from the oil cartridge heater. The incoming cold oil exacerbates the oil impingement problem. Keeping the oil temperature at or below the watt density heating formula for waste oil keeps oil oxidation in the aluminum preheater at a minimum; however, the negative trade-off is oil impingement.

1. The retention head designs on the market allowed oil droplets to escape from the edge of the retention head, and fly to the sides of the combustion chamber (the theory of the retention head is to increase thermal efficiency by twisting and increasing the air-to fuel mixture, and forcing the unburnt and heavier droplets of oil into the oxidation zone.) In the improved KAGI design, a 5/8 inch stainless steel sleeve is extended to the outside of the retention head. This guides the unburnt oil droplets and vapor into the flame, raising the thermal efficiency of the burner.
2. The manufacturers who have used the old design retention head on their burners have put the slotted portion on the bottom to allow oil to drip from the nozzle into the chamber. In the Kagi design, the oil does not drain through the tight slots as waste oil is very thick. A larger hole, 3/8 inch diameter, is needed, which is located on the inside portion from the fins with an additional tapered slot from the fin area to the edge of the

retention head.
You will experience instant ignition and more heat, using less oil, than before using the new Kagi flame cone (retention head).

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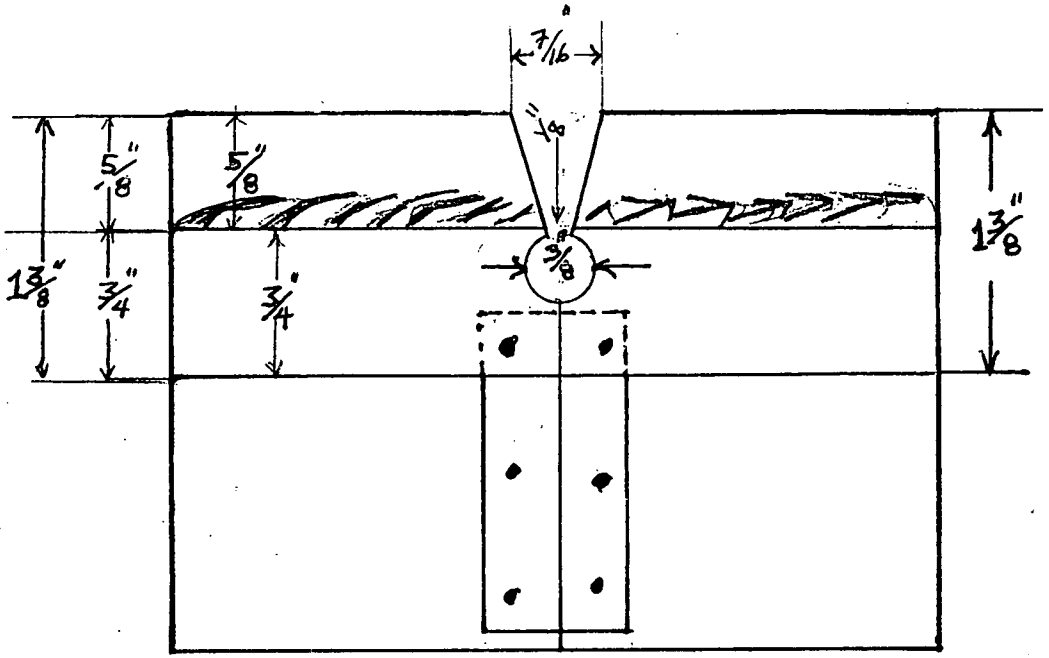
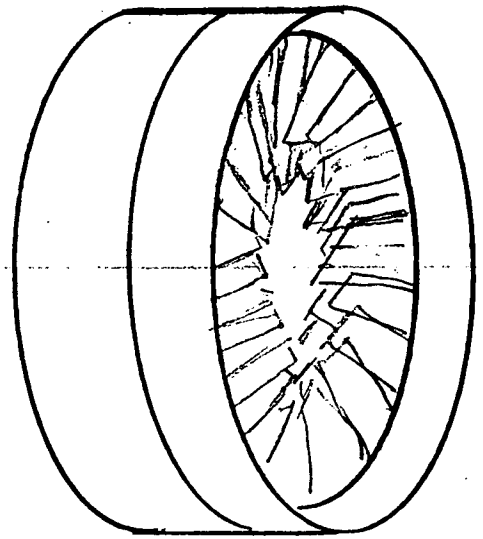


DRAWING TO ACTUAL SCALE

BOTTOM VIEW OF RETENTION HEAD WITH
PROPER SIZE AND POSITION OF OIL DRAIN HOLE



SIDE VIEW NOT TO SCALE

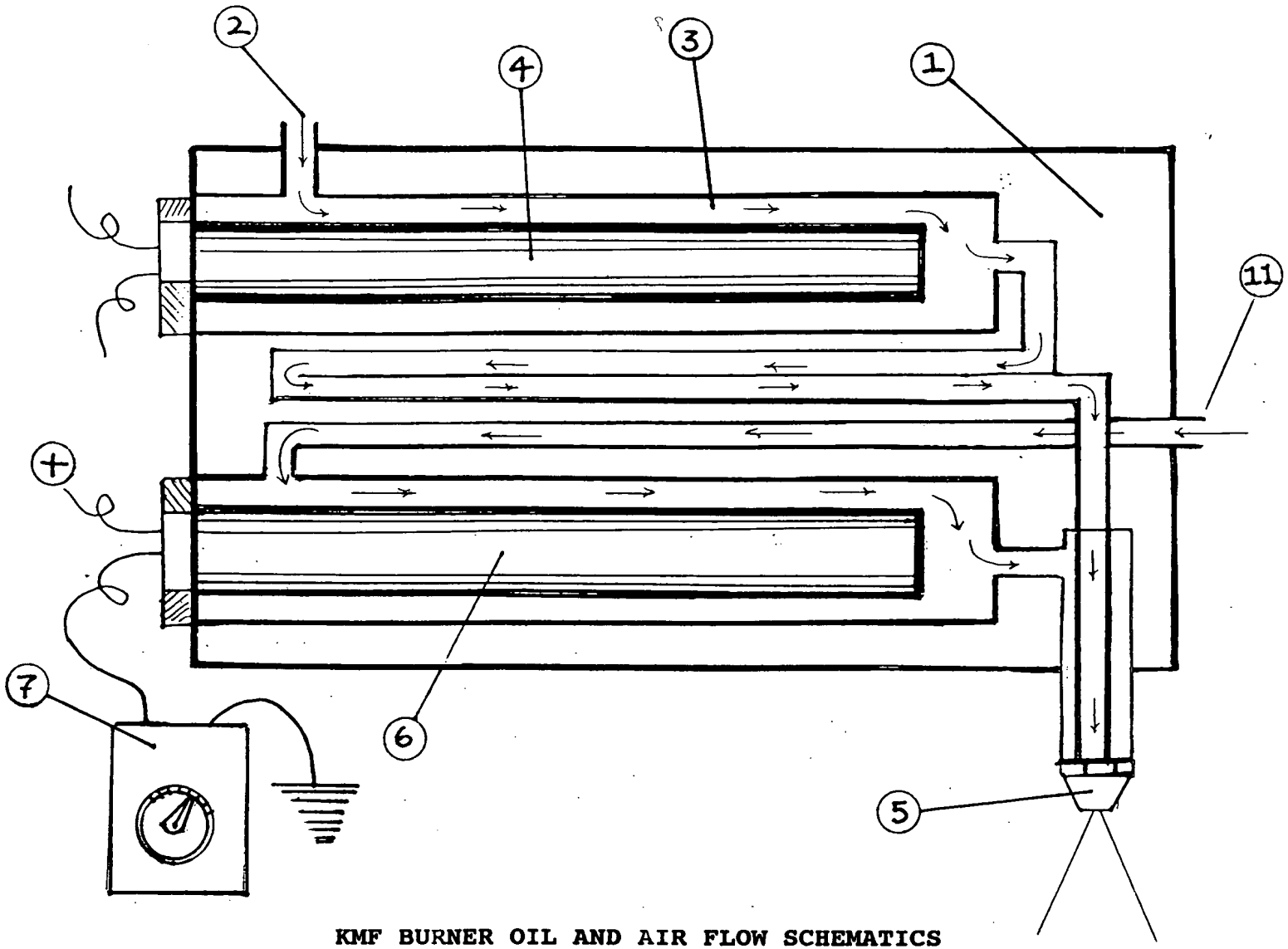
THE NEW KAGI NB RETENTION HEAD (FLAME CONE)

FUEL AND AIR FLOW SCHEMATIC OF THE KAGI MULTI-FUELED BURNER:

When the Kagi Multi-fueled burner (KMFB) calls for heat, cold waste oil from a remote oil pump located at the storage tank enters aluminum preheater block (#1) at oil entrance port (#2). Oil enters oil chamber (#3) and flows over the surface sheath of the oil heating element (#4). Oil zigzags through the oil passages and picks up heat on its way to the nozzle (#5). The aluminum block (#1) is heated by another heating element #6 which is preset by a block thermostat (#7), and is always left on. Compressed air enters the air regulator (#8) which reduces the line pressure from 200 PSI to 15-20 PSI and enters the air solenoid (#9) which is normally closed. When the solenoid is energized, compressed air exits the solenoid and enters the air pressure cumulative storag tank (#10), and tries to fill it. The air exits the tank (#10) and enters the aluminum block (#1) at preheater air port (#11), and zigzags through the aluminum block, picking up heat on its way, and flows over the hot surface sheath of the heating element (#6) onward to the nozzle (#5). The compressed air whistles out from the nozzle, and, through venturi action, sucks the oil from the oil passage and spins and atomizes the oil into a fine spray for ignition. When the burner calls for ignition, since the compressed air is trying to fill up the air tank (#10), the air exits from th nozzle (#5) gradually. This nrich s th fu l-to-air mixture and enhanc s ignition. This is similar to th function of a choke on an auto carburetor. Th oth r b nefit f this air tank (#10) is wh n th burn r cycl s off, ther is r sidual air pr ssur in th

tank that blows out th r sidual il l ft in th n zzle assembly, minimizing oil dripping from th nozzl (#5).

KMF ALUMINUM PREHEATER BLOCK WITH AIR AND OIL HEATING ELEMENTS



KMF BURNER OIL AND AIR FLOW SCHEMATICS